

REMARKS

Claims 1, 3 and 6 through 9 are amended. Thus, claims 1 through 6 are presented for examination as amended.

Claims amendments have been made to eliminate element numbering and multiple dependencies and correct typographical errors. No new matter is added by the changes made herein.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Elliott N. Kramsky", is written over the printed name.

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Title: METHOD FOR COMPENSATION FOR A ZERO ERROR IN
A CORIOLIS GYRO

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5

BACKGROUND

Field of the Invention

The present invention relates to Coriolis
gyros. More particularly, this invention pertains ~~The~~
~~invention relates~~ to a method for compensation for a
10 zero error in a Coriolis gyro.

Description of the Prior Art

Coriolis gyros (also referred to as
"vibration gyros") are in increasing use for ~~being used~~
~~increasingly for~~ navigation. ~~purposes.~~ They possess
15 ~~Coriolis gyros have~~ a mass system that ~~which~~ is caused
to oscillate with the ~~This~~ oscillation ~~is~~ generally
being a superimposition of a large number of individual
oscillations.

The ~~These~~ individual oscillations of the mass
20 system are initially independent of one another and can
~~each~~ be referred to abstractly as "resonators". At
least two resonators are required for operation of a
vibration gyro: one ~~of these resonators~~ (the first

resonator) is artificially stimulated to oscillate, and this is referred to below ~~in the following text~~ as the "stimulating oscillation". The other resonator (the second resonator) is stimulated to oscillate only when
5 the vibration gyro is moved/rotated. This is because Coriolis forces occur in this case, that ~~which~~ couple the first resonator to the second resonator, absorb energy from the stimulating oscillation for the first resonator, and transfer it ~~this~~ to the read oscillation
10 of the second resonator. The oscillation of the second resonator is referred to below ~~in the following text~~ as the "read oscillation".

In order to determine movements (in
15 particular rotations) of the Coriolis gyro, the read oscillation is tapped off and a corresponding read signal (e.g. ~~for example~~ the read oscillation tapped-off signal) is investigated to determine whether any changes have occurred in the amplitude of the read
20 oscillation as they ~~which~~ represent a measure of the rotation of the Coriolis gyro.

Coriolis gyros may be implemented as both open-loop ~~open-looped systems~~ and ~~as~~ closed-loop ~~closed-looped~~ systems. In a closed-loop system, the

amplitude of the read oscillation is continuously reset to a fixed value (preferably zero) ~~by~~ via respective control loops.

~~An~~ One example of a closed-loop version
5 of a Coriolis gyro will be described below in
conjunction with ~~in the following text, with reference~~
~~to Figure 2, a schematic diagram of a Coriolis gyro in~~
~~accordance with the prior art in order to illustrate~~
~~further the method of operation of a Coriolis gyro.~~
10 ~~The A~~ Coriolis gyro 1 includes ~~such as this has~~ a mass
system 2 that ~~which~~ can be caused to oscillate and is
also referred to below ~~in the following text~~ as a
"resonator". ~~(A distinction~~ exists ~~must be drawn~~
between this expression and the abstract "resonators"
15 term previously employed for ~~mentioned above, which~~
~~represent~~ individual oscillations of the "real"
resonator. As ~~already~~ mentioned, the resonator 2 may
be considered ~~regarded~~ as a system composed of two
"resonators" (~~a~~ the first resonator 3 and ~~a~~ the second
20 resonator 4)). Each of ~~Both~~ the first and the second
resonators resonator 3, 4 is ~~are each~~ coupled to a
force sensor (not shown) and to a tapping system (not
shown). The noise ~~which is~~ produced by the force
sensors and the tapping systems is indicated

schematically ~~here~~ by Noise1 (reference symbol 5) and Noise2 (reference symbol 6).

The Coriolis gyro 1 includes ~~furthermore~~ ~~has~~ four control loops. A first control loop controls ~~is used to control~~ the stimulating oscillation (that is to say the frequency of the first resonator 3) at a fixed frequency (resonant frequency). It comprises ~~The first control loop has~~ a first demodulator 7, a first low-pass filter 8, a frequency regulator 9, a VCO
10 (voltage controlled oscillator) 10 and a first modulator 11.

A second control loop controls ~~is used to control~~ the stimulating oscillation at constant amplitude. It comprises ~~and has~~ a second demodulator
15 12, a second low-pass filter 13 and an amplitude regulator 14.

A Third and a Fourth control loops ~~loop~~ are employed ~~used~~ to reset the ~~those~~ forces that ~~which~~ stimulate the read oscillation. ~~In this case,~~ The
20 third control loop includes ~~has~~ a third demodulator 15, a third low-pass filter 16, a quadrature regulator 17 and a third modulator 22 while the fourth control loop

~~comprises~~ ~~contains~~ a fourth demodulator 19, a fourth low-pass filter 20, a rotation rate regulator 21 and a second modulator 18.

The first resonator 3 is stimulated at
5 ~~its~~ resonant frequency ω_1 . The resultant stimulating oscillation is tapped off, ~~is~~ phase-demodulated by means of the first demodulator 7, and a demodulated signal component is supplied to the first low-pass filter 8; that ~~which~~ removes the sum frequencies. ~~from~~
10 ~~it.~~ (The tapped-off signal is also referred to below ~~in the following text~~ as the stimulating oscillation tapped-off signal.) An output signal from the first low-pass filter 8 is applied to a frequency regulator 9 which controls the VCO 10, as a function of the signal
15 supplied to it, such that the in-phase component essentially tends to zero. ~~For this purpose,~~ The VCO 10 passes a signal to the first modulator 11, which ~~itself~~ controls a force sensor such that a stimulating force is applied to the first resonator 3. When ~~if~~ the
20 in-phase component is zero, ~~then~~ the first resonator 3 oscillates at its resonant frequency ω_1 . (It should be noted ~~mentioned~~ that all of the modulators and demodulators are operated on the basis of ~~this~~ resonant frequency ω_1 .)

The stimulating oscillation tapped-off signal is also applied ~~supplied~~ to the second control loop and ~~is~~ demodulated by the second demodulator 12. The output of the second demodulator 12 ~~whose output is~~ passed to the second low-pass filter 13, whose output ~~signal~~ is, in turn, applied ~~supplied~~ to the amplitude regulator 14. The amplitude regulator 14 controls the first modulator 11 in response to ~~as a function of~~ this signal and the output of a nominal amplitude sensor 23 ~~to cause such that~~ the first resonator 3 to oscillate ~~oscillates~~ at a constant amplitude (i.e. ~~that is to say~~ the stimulating oscillation has a constant amplitude).

~~As has already been mentioned~~ above, Coriolis forces (indicated by the term $FC \cdot \cos(\omega_1 t)$ in Figure 2) ~~the drawing~~ occur on movement/rotation of the Coriolis gyro 1. They ~~which~~ couple the first resonator 3 to the second resonator 4, and thus cause the second resonator 4 to oscillate. A resultant read oscillation of ~~at the~~ frequency ω_2 is tapped off and ~~so~~ ~~that~~ a corresponding read oscillation tapped-off signal (read signal) is supplied to both the third and the fourth control loops. ~~loop.~~ This signal is demodulated in the third control loop by the third demodulator 15, sum frequencies are removed by the third low-pass

filter 16, and the low-pass-filtered signal is supplied to the quadrature regulator 17. ~~The~~ whose output of the quadrature regulator 17 ~~signal~~ is applied to the third modulator 22 ~~so as~~ to reset corresponding

5 quadrature components of the read oscillation.

Analogously, ~~to this,~~ the read oscillation tapped-off signal is demodulated in the fourth control loop by the fourth demodulator 19, passed ~~passes~~ through the fourth low-pass filter 20, and the ~~a correspondingly~~ low-pass-

10 filtered signal then is applied ~~on the one hand~~ to the rotation rate regulator 21 (whose output ~~signal~~ is proportional to the instantaneous rotation rate and is passed as a rotation rate measurement ~~result~~ to a rotation rate output 24) and ~~on the other hand~~ to the

15 second modulator 18 that ~~which~~ resets corresponding rotation rate components of the read oscillation.

A Coriolis gyro 1 as described above may be operated in both ~~a~~ double-resonant ~~form~~ and ~~in a~~ non-double-resonant forms ~~form~~. When ~~if the Coriolis~~

20 ~~gyro 1 is~~ operated in a double-resonant form, ~~then~~ the frequency ω_2 of the read oscillation is approximately equal to that ~~the frequency~~ of the stimulating oscillation (ω_1). ~~while, in contrast,~~ In the non-double-resonant case, the frequency ω_2 of the read

oscillation differs ~~is different~~ from the frequency ω_1 .
~~of the stimulating oscillation.~~ In the case of double
resonance, the output signal from the fourth low-pass
filter 20 contains corresponding information about the
5 rotation rate. ~~while,~~ In contrast ~~in the~~ (non-double-
resonant case), the output signal from the third low-
pass filter 16 contains the rotation rate information.
In order to switch between the ~~different~~ double-
resonant and non-double-resonant operating modes, a
10 doubling switch 25 ~~is provided, which~~ selectively
connects the outputs of the third and the fourth low-
pass filter 16, 20 to the rotation rate regulator 21
and the quadrature regulator 17.

As a result of unavoidable manufacturing
15 tolerances, ~~it is necessary to take account of~~ slight
misalignments exist between the stimulating
forces/resetting forces/force sensors/taps and the
natural oscillations of the resonator 2 (i.e. ~~that is~~
~~to say~~ the real stimulating and reading modes of the
20 resonator 2). Such misalignments must be taken into
account as ~~This means that~~ the read oscillation tapped-
off signal is otherwise subject to errors. In such a
situation ~~such as this,~~ the read oscillation tapped-off
signal is thus includes ~~composed of~~ a part that ~~which~~

originates from the real read oscillation, and one that
~~of a part which~~ originates from the real stimulating
oscillation. The undesired part causes a Coriolis gyro
zero error of unknown whose magnitude as however, is
5 ~~unknown, since~~ it is impossible to distinguish between
these two parts when the read oscillation tapped-off
signal is tapped off.

SUMMARY OF THE INVENTION

It is therefore an object of the object on
10 ~~which~~ the invention ~~is based is~~ to provide a method for
compensation for ~~which allows~~ the above-described zero
error ~~described above to be determined.~~

~~This object is achieved by the method as~~
~~claimed in the features of patent claim 1. The~~
15 ~~invention also provides a Coriolis gyro as claimed in~~
~~patent claim 6. Advantageous refinements and the~~
~~developments of the idea of the invention can be found~~
~~in the respective dependent claims.~~

The present invention provides, in a first
20 aspect, ~~According to the invention, in the case of a~~
method for compensation for ~~determination of~~ a zero
error in ~~of~~ a Coriolis gyro. In such method, the

frequency ~~(preferably the resonant frequency)~~ of the
read oscillation is modulated. The output signal from
a rotation rate control loop or quadrature control loop
for the Coriolis gyro is demodulated in synchronism
5 with the modulation of the frequency ~~(resonant
frequency)~~ of the read oscillation ~~in order~~ to obtain
an auxiliary signal which is a measure of the zero
error. A compensation signal is then produced and ~~is~~
passed to the input of the rotation rate control loop
10 or quadrature control loop. ~~with~~ The compensation
signal ~~is being~~ controlled ~~so such~~ that the magnitude
of the auxiliary signal is as small as possible.

~~In this case, the expression "resonate",
means the entire mass system of the Coriolis gyro that
15 can be caused to oscillate, that is to say with
reference to Figure 2, that part of the Coriolis gyro
which is identified by the reference number 2.~~

In a second aspect, the invention ~~The~~
20 ~~invention also~~ provides a Coriolis gyro that includes
~~which is characterized by~~ a device for determination of
the zero error. ~~of the Coriolis gyro, having:~~

Such device includes a modulation unit that

~~which~~ modulates the frequency of the read oscillation
of the Coriolis gyro. A demodulation unit is provided
that ~~which~~ demodulates the output signal from a
rotation rate control loop or quadrature control loop
5 ~~of the Coriolis gyro~~ in synchronism with ~~the~~ modulation
of the frequency of the read oscillation ~~in order~~ to
obtain an auxiliary signal that ~~which~~ is a measure of
the zero error. ~~and~~ A control unit ~~which~~ produces a
compensation signal and passes it ~~this~~ to the input of
10 the rotation rate control loop or quadrature control
loop. ~~with~~ The control unit controls ~~controlling~~ the
compensation signal so ~~such~~ that the auxiliary signal
is as small as possible.

~~The invention will be described in more detail in the~~
15 ~~form of an exemplary embodiment in the following text,~~
~~with reference to the accompanying figures in which.~~

The foregoing and other features of the
invention will become further apparent from the
detailed description that follows. Such description is
20 accompanied by a set of drawing figures. Numerals of
the drawing figures, corresponding to those of the
written description, point to the features of the
invention with like numerals referring to like features

throughout both the drawing figures and the written description.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 ~~is a~~ shows the schematic diagram
5 ~~design of a Coriolis gyro in accordance with which is~~
~~based on the method according to the invention;~~

Figure 2 ~~is a~~ shows the schematic diagram
~~design of a conventional Coriolis gyro in accordance~~
with the prior art;

10 Figure 3 is a vector diagram for illustrating
~~shows a sketch in order to explain the interaction of~~
~~the resonator, force sensor system and tapping system~~
~~in a Coriolis gyro;~~

Figures 4a through to 4d are a set of vector
15 diagrams for illustrating ~~show a sketch in order to~~
~~explain the forces and oscillation amplitudes for a~~
~~Coriolis gyro at double resonance;~~

Figures 5a through to 5d are a set of vector
diagrams for illustrating ~~show a sketch in order to~~
20 ~~explain the forces and oscillation amplitudes for a~~

Coriolis gyro close to double resonance;

Figures 6a through to 6d are a series of
vector diagrams for illustrating ~~show a sketch in order~~
~~to explain~~ the method according to the invention at
5 double resonance; and

Figures 7a through to 7d are a series of
vector diagrams for illustrating ~~show a sketch in order~~
~~to explain~~ the method according to the invention close
to double resonance.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

~~First of all,~~ The general method of operation
of a Coriolis gyro is will be explained once again with
reference to the vector diagrams on the basis of
Figures 3 to 5, ~~in the form of a vector diagram~~
15 ~~illustration~~ (Gaussian number plane). The method of
~~according to the invention functions operates only at~~
~~when is~~ essentially double resonance ~~present~~ (on
average). The Drawings labeled ~~which are annotated~~
~~with "close to double resonance"~~ illustrate ~~show~~ the
20 changed conditions when the situation of "close to
double resonance" occurs as a result of modulation of
the resonant frequency of the read oscillation.

The vector diagram of Figure 3 illustrates
~~shows, schematically,~~ a Coriolis gyro ~~to be more~~
~~precise a~~ (system 40) comprising a resonator (not
shown), a force sensor system 41 and a tapping system
5 42 ~~in a Coriolis gyro~~. Possible oscillations x
(stimulation) and y (read) are also indicated. Such
oscillations ~~which~~ are coupled to one another by
Coriolis forces in the event of rotation ~~rotations~~ at
right angle ~~angles~~ to the plane of the drawing. The x
10 oscillation (complex; purely imaginary at resonance) is
stimulated by an ~~the~~ alternating force with the complex
amplitude F_x (in this case only the real part F_{xr}).
The y oscillation (complex) is reset by an ~~the~~
alternating force of ~~the~~ complex amplitude F_y with the
15 real part F_{yr} and the imaginary part F_{yi} . (The
rotation vectors $\exp(i\omega t)$ are omitted in each case).

Figures 4a to 4d illustrate the forces and
oscillation amplitude for a Coriolis gyro at double
resonance. That is, they show the complex forces and
20 complex oscillation amplitudes for an ideal Coriolis
gyro with the same resonant frequency for the x and y
oscillations ~~(double resonance)~~. The force F_{xr} is
controlled ~~so as~~ to produce a purely imaginary,

constant x oscillation. This is achieved by the ~~an~~
amplitude regulator 14 (which controls the magnitude of
the x oscillation) and the ~~by a~~ phase regulator
10/frequency regulator 9 (which controls the phase of
5 the x oscillation). The operating frequency ω_1 is
controlled so ~~such~~ that the x oscillation is purely
imaginary (i.e., ~~that is to say~~ the real part of the x
oscillation is controlled to be zero).

The Coriolis force during rotation, FC, is
10 now purely real, since it ~~the Coriolis force~~ is
proportional to the speed of the x oscillation. If
both oscillations have the same resonant frequency,
then the y oscillation, caused by the force FC, has the
form illustrated in Figure 4d. If the resonant
15 frequencies of the x and y oscillations differ
slightly, then complex forces and ~~complex~~ oscillation
amplitudes occur as illustrated ~~with the form as shown~~
in Figures 5a to 5d. In particular, this results in a
y oscillation, stimulated by FC, as shown in Figure 5d.

20 When double resonance is present, the real
part of the y tapped-off signal is zero. ~~but, in~~
~~contrast,~~ It is not zero in the absence of double
resonance. In both cases, with reset gyros, the

Coriolis force FC is zeroed by a regulator Fyr which compensates for FC. In the case of Coriolis gyros ~~which are~~ operated with double resonance, the imaginary part of y is zeroed by ~~means of~~ Fyr, and the real part
5 of y is zeroed by ~~means of~~ Fyi. The bandwidths ~~bandwidth~~ of the two control processes are ~~is~~ approximately 100 Hz.

~~The method according to the invention will now be explained in more detail, using an exemplary~~
10 ~~embodiment, with reference to Figure 1.~~

Figure 1 is a schematic diagram of a Coriolis gyro in accordance with the invention. Parts and ~~devices which~~ corresponding ~~correspond~~ to those of the ~~prior art gyro of~~ from Figure 2 are annotated with the
15 same reference symbols ~~in the drawings,~~ and ~~will not~~ again explained ~~again~~.

The A resetting Coriolis gyro 1' of Figure 1 includes ~~is additionally provided with~~ a demodulation unit 26, a fifth low-pass filter 27, a control unit 28,
20 a modulation unit 29 and a first multiplier 30 or, alternatively, a second multiplier 31. The modulation unit 29 modulates the frequency of the read oscillation

of the resonator 2 at a ~~frequency~~ ω_{mod} . An output
signal from the quadrature control loop is supplied to
the demodulation unit 26. It which demodulates this
signal in synchronism with the frequency ω_{mod} ~~in order~~
5 to obtain an auxiliary signal. Should there be if
~~there is~~ any zero error (i.e. due, for example, to that
~~is to say if there are any~~ misalignments between the
stimulating forces/resetting forces/force sensors/taps
and the natural oscillations of the resonator 2) ~~then~~
10 the strength of the auxiliary signal will then vary
~~varies~~ as a function of the frequency of the read
oscillation.

The auxiliary signal is supplied to the fifth
low-pass filter 27, which produces a low-pass-filtered
15 signal and supplies it this to the control unit 28.
The control unit 28 employs ~~uses~~ the low-pass-filtered
auxiliary signal to produce ~~as the basis for producing~~
a signal which is applied ~~emitted~~ to the first
multiplier 30. This multiplies the signal emitted from
20 the control unit 28 by a signal that which originates
from the amplitude regulator 14 to control for
~~controlling~~ the amplitude of the stimulating
oscillation.

A compensation signal, ~~which is~~ obtained from the multiplication process, is added to the input to the rotation rate control loop. The control unit 28 controls the signal supplied to the first multiplier 30
5 so such that the magnitude of the auxiliary signal is as small as possible. This corrects the zero error. ~~Furthermore,~~ The magnitude of the zero error can be determined by the compensation signal, which represents a measure of the zero error. Alternatively, the output
10 signal from the control unit 28 can be supplied to the second multiplier 31, which multiplies this signal by the stimulating oscillation tapped-off signal and adds a compensation signal, ~~which is~~ produced in this way, to the read oscillation tapped-off signal. (The
15 expression "control unit" is not restricted to the control unit 28 but may also mean the combination of the control unit 28 and the first or second multiplier 30, 31).

The signal ~~which is~~ supplied to the
20 demodulation unit 26 may alternatively be tapped-off at a different point within the control loops, ~~as well.~~

The method of the ~~according~~ to invention ~~that~~
~~has just been described~~ can also be illustrated as

~~follows~~, with reference to Figures 6a to 6d and 7a to 7d. The tap for the y oscillation (second resonator x2, 4) in general also "sees" a part of the x oscillation (first resonator x1, 3): $a_{21} \cdot x$. This
5 produces results in a Coriolis gyro zero error (to which must be determined). Figures 6a through to 6d illustrate ~~show~~ the situation at double resonance, while Figures 7a through to 7d illustrate ~~show~~ the situation at close to double resonance. In both cases,
10 the sum signal of the actual y movement and $a_{21} \cdot x$ is "zeroed" by means of F_{yi} and F_{yr} . If a_{21} is not equal to zero, F_{xr} is not equal to zero when the rotation rate is zero (zero error). F_{yi} becomes zero only when double resonance is present. A quadrature bias results
15 when there are discrepancies in the resonant frequencies.

The Compensation for a_{21} is accomplished now ~~carried out~~, according to the invention, as follows. The gyro is assumed to be at double resonance. The
20 resonant frequency of the read oscillation (which can be electronically detuned) is modulated by the modulation unit 29 with a zero mean value (e.g. for ~~example~~ at 55 Hz). ~~and~~ The signal F_{yi} is demodulated by the demodulation unit 26 in synchronism when the

resetting control loops are closed. If a_{21} were zero, then F_{yi} would not vary with ~~the~~ frequency. That is, ~~to say~~ it changes only ~~in the situation~~ where a_{21} is not equal to zero. In the latter case, the low-pass-
5 filtered, synchronously demodulated F_{yi} signal is not ~~equal to~~ zero. The demodulated signal is supplied to the control unit 28 (preferably in the form of software), which controls a factor a_{21comp} (auxiliary variable). A controlled component of the x movement,
10 $a_{21comp} \cdot x$, is tapped off from the signal at the y tap (preferably in software). The magnitude of the ~~this~~ component a_{21comp} is controlled so ~~such~~ that the demodulated F_{yi} signal becomes zero. There is, therefore, no longer any x signal component in the
15 signal from the y tap that has been cleaned in this way and the bias due to ~~caused by the~~ read cross-coupling disappears. At double resonance and with the same Q factors, ~~just~~ a cross-coupling regulator would zero the bias caused by the read cross-coupling on its own.
20 This is due to the fact that ~~because~~ the modulation of F_{xr} also slightly modulates the amplitude of x . The sum of the force component of x in F_{yr} and the read component of x at the y tap is thus zeroed via the force cross-coupling regulator. The bias therefore
25 ~~thus~~ disappears if the Q factor is the same.

~~Alternatively,~~ It is also possible to use noise to modulate the read oscillation. Appropriate synchronous demodulation of the noise component in the read signal is then employed. ~~used in a situation such~~
5 ~~as this.~~

One major discovery on which the invention is based is that the output signal from the rotation rate control loop/quadrature control loop changes as a result of a change in the frequency of the read
10 oscillation only when there is a corresponding zero error (i.e. that is to say when misalignments exist between the stimulating forces/resetting forces/force sensors/taps and the natural oscillations of the resonator). Thus, if a compensation signal that ~~which~~
15 compensates for the zero error in the read oscillation tapped-off signal caused by misalignments is passed to the input of the rotation rate control loop/quadrature control loop, or directly to the read oscillation tapped-off signal, ~~then~~ the output signal from the
20 rotation rate control loop/quadrature control loop does not change further ~~any more either~~ in the event of a change in the frequency (in particular, a change in the resonant frequency) of the read oscillation. Since the

change in the output signal from the rotation rate control loop/quadrature control loop is recorded by the auxiliary signal, the zero error can be determined and compensated for as follows by controlling the

5 compensation signal so ~~is controlled such~~ that the auxiliary signal (and, thus, the change in the output signal from the control loop) is as small as possible. The frequency (resonant frequency) of the read oscillation is preferably modulated with zero mean

10 value, (e.g. for example at 55 Hz).

~~The auxiliary signal is preferably low-pass filtered, and the compensation signal is produced on the basis of the low-pass-filtered auxiliary signal. The compensation signal may be produced, for example, by~~

15 ~~multiplication of a controlled signal, which is produced on the basis of the auxiliary signal, by a signal which originates from an amplitude regulator for controlling the amplitude of the stimulating oscillation. The auxiliary signal is preferably~~

20 ~~determined from the output signal from the quadrature control loop, and the compensation signal is passed to the input of the rotation rate control loop.~~

While this invention has been illustrated

with reference to its presently-preferred embodiment,
it is not limited thereto. Rather, the invention is
limited only insofar as it is defined by the following
set of patent claims and includes within its scope all
equivalents thereof.

What is claimed is:

~~Patent claims~~

- 1 1. A method for compensation for a zero error in a
2 Coriolis gyro (1'), in which:
3 - the frequency of the read oscillation is
4 modulated,
5 - the output signal from a rotation rate control
6 loop or quadrature control loop for the Coriolis gyro
7 (1') is demodulated in synchronism with the modulation
8 of the frequency of the read oscillation in order to
9 obtain an auxiliary signal which is a measure of the
10 zero error,
11 - a compensation signal is produced, and is passed
12 to the input of the rotation rate control loop or
13 quadrature control loop, with
14 - the compensation signal being controlled such that
15 the magnitude of the auxiliary signal is as small as
16 possible.
- 1 2. The method as claimed in claim 1, characterized in
2 that the modulation of the frequency of the read
3 oscillation is a modulation with a zero mean value.

1 3. The method as claimed in claim 1 or 2,
2 characterized in that the auxiliary signal is low-pass-
3 filtered, and the compensation signal is produced on
4 the basis of the low-pass-filtered auxiliary signal.

1 4. The method as claimed in claim 1, characterized in
2 that the compensation signal is produced by
3 multiplication of a controlled signal, which is
4 produced on the basis of the auxiliary signal, by a
5 signal which originates from an amplitude regulator for
6 controlling the amplitude of the stimulating
7 oscillation.

1 5. The method as claimed in one of the preceding
2 claims, characterized in that the auxiliary signal is
3 determined from the output signal from the quadrature
4 control loop, and the compensation signal is passed to
5 the input of the rotation rate control loop.

1 6. A Coriolis gyro (1'), characterized by a device
2 for determination of the zero error of the Coriolis
3 gyro (1'), having:
4 - a modulation unit (29) which modulates the
5 frequency of the read oscillation of the Coriolis gyro
6 (1'),
7 - a demodulation unit (26), which demodulates the
8 output signal from a rotation rate control loop or
9 quadrature control loop of the Coriolis gyro (1') in
10 synchronism with the modulation of the frequency of the
11 read oscillation, in order to obtain an auxiliary
12 signal which is a measure of the zero error, and
13 - a control unit (28), which produces a compensation
14 signal and passes this to the input of the rotation
15 rate control loop or quadrature control loop, with the
16 control unit (28) controlling the compensation signal
17 such that the auxiliary signal is as small as possible.

ABSTRACT

~~Method for compensation for a zero error in a~~
~~Coriolis gyro~~

~~In~~ A method for compensation ~~determination~~ of the zero error of a Coriolis gyro. ~~(1')~~, The frequency of the read oscillation is modulated. The output signal from a rotation rate control loop or quadrature control loop for the Coriolis gyro ~~(1')~~ is demodulated in synchronism with the modulation of the frequency of the read oscillation ~~in order~~ to obtain an auxiliary signal. The auxiliary signal ~~which~~ is a measure of the zero error. A compensation signal is produced and ~~is~~ passed to the input of the rotation rate control loop or quadrature control loop, with the compensation signal being controlled such that the magnitude of the auxiliary signal is as small as possible.

~~(Figure 1)~~